

Interactive comment on “Airborne observations of far-infrared upwelling radiance in the Arctic” by Quentin Libois et al.

Anonymous Referee #2

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This paper describes the first field application of a far IR radiometer operated on-board the Polar 6 aircraft over Arctic regions during the NETCARE campaign. The paper shows the importance to measure the far IR spectral region and how much these measurements, acquired in all-sky conditions, can improve the sensitivity to specific humidity and the cooling rate of thin ice clouds.

General comment: The paper is well written, clear in the description of the field campaign, and convincing in showing the importance to cover this observational gap in the spectral range of the IR emission. The data analysis is limited to few cases with few general implications for atmospheric science. However, considering that it belongs to the NETCARE special issue, I think that the paper is worth to be published in ACP and of general interest for the Earth radiation budget community.

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Some changes are required to improve the figures and the description as indicated here below.

- Introduction. Some more references about the available measurements in Arctic should be added, e.g from ICECAPS experiment or the CANDAC network, in order to better stress the contribution of these new measurements.
- page 5 line 1. Does the same radiometric resolution apply to all the spectral bands ? If not, I would put the numbers in Tab.1 otherwise please clarify the text. Furthermore, is the radiometric resolution limited by the detector noise or by other reasons ? I would add some more information about the noise on the different channels and the related radiometric resolution, even if this is characterized in laboratory conditions.
- page 6 line 2-4. It would be interesting to describe with more details the refinement introduced to better account for quick temperature variations. Otherwise this sentence is too general and not useful.
- page 6 line 17-18. It is not clear whether the images were used or not. If not I would avoid to cite this probe.
- page 7 line 2. 5 cases are too few cases to provide a real overview of the Arctic conditions, they are an example of different conditions. Please rephrase the sentence.
- page 8 sect. 3. Since this paper is published in ACP, even if it is mainly an instrumental paper, I would try to introduce since here the general scientific results expected in the framework of the NETCARE campaign in order to give more evidence to the peculiar results of this work within the general scientific problem of the special issue.

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- page 8 line 18. Please clarify whether the value of $0.015 \text{ W m}^{-2} \text{ sr}^{-1}$ applies to all the bands.
- page 8 line 25. This sentence is not completely clear because the calibration is not described. Furthermore, Sect 3.1 addresses the radiometric performance in terms of temperature resolution. It would be also interesting to have an idea of the absolute error of the measurement.
- page 11 line 6. I would say a "close agreement" above 2 km, below the difference is always more than 0.6 W m^{-2} .
- page 12 line 3-4. If the peak is not present on the way down, please show this case in the figure.
- page 11 fig. 4. In panel (b) the x-axis label should be Brightness temperature. I would also remove the temperature curve which is also shown in panel (a). Same for Fig. 6 panel (b) and (d).
- page 13 line 10. Do you have some information about these clouds from CALIPSO ?
- page 13 line 17. In the comparison with simulation you should estimate the noise on measurements due to scene variations. Besides the aircraft movement considered here, please add some more considerations at least about the roll of the platform.
- page 13 line 26-27. The sentence "They are of little interest ..." is too general. This spectral range can be of great interest for satellite observations because you can see high altitude clouds.
- page 16 fig.8. As said before, I would use Brightness temperature for x-axis in panel (b) and show the temperature profile only in panel (a). Same for Fig.9.

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- page 19 line 6. Since resolution was used for the radiometric measurement, the sentence is not clear. I would say: ... temperature variations of 0.2 K are detectable with a vertical resolution of ...
- General comment on figures. The font size of labels and scales in most of the figures should be enlarged to be clearer.

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